

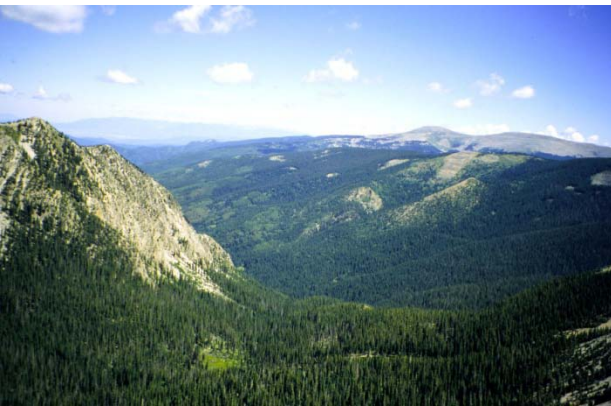
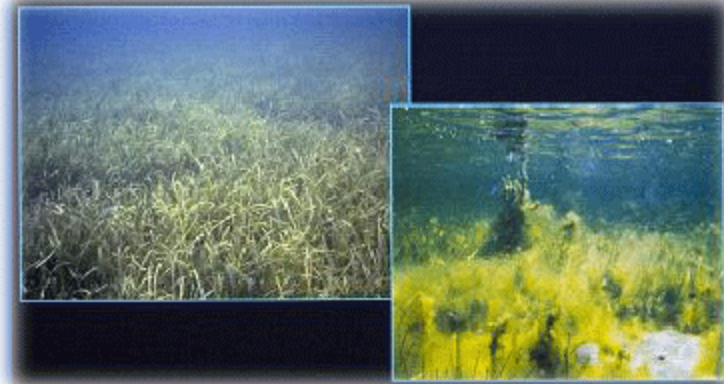
US EPA ARCHIVE DOCUMENT



Sustainable nitrogen management

EPA's Sustainable & Healthy Communities Research Program

Jana Compton – US EPA (ORD NHEERL WED) Corvallis Oregon



Sustainable and Healthy Communities Research Program



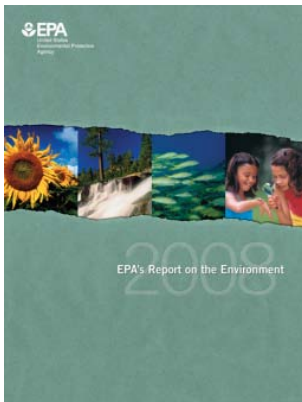
Theme 1: Data and Tools to Support Sustainable Community Decisions

Theme 2: Forecasting and Assessing Ecological and Community Health

Theme 3: Near-term Approaches for Sustainable Solutions

- Contaminated Sites
- Materials Management and Sustainable tech
- Integrated management of reactive N
- Report on the Environment

Theme 4: Integrated Solutions for Sustainable Outcomes



SHC Nitrogen Team

NHEERL

Jana Compton WED

Steve Jordan GED

Brian Hill MED

Russ Kreis MED

Hal Walker AED

Jeff Hollister AED

Cathy Wigand AED

Stephen Hale AED

NERL

Robin Dennis AMAD

Ellen Cooter AMAD

Dorsey Worthy ESD

NRMRL

Ken Forshay GWERD

NCEA

Tara Greaver

Chris Clark

OAR and OAQPS

Randy Waite OAQPS

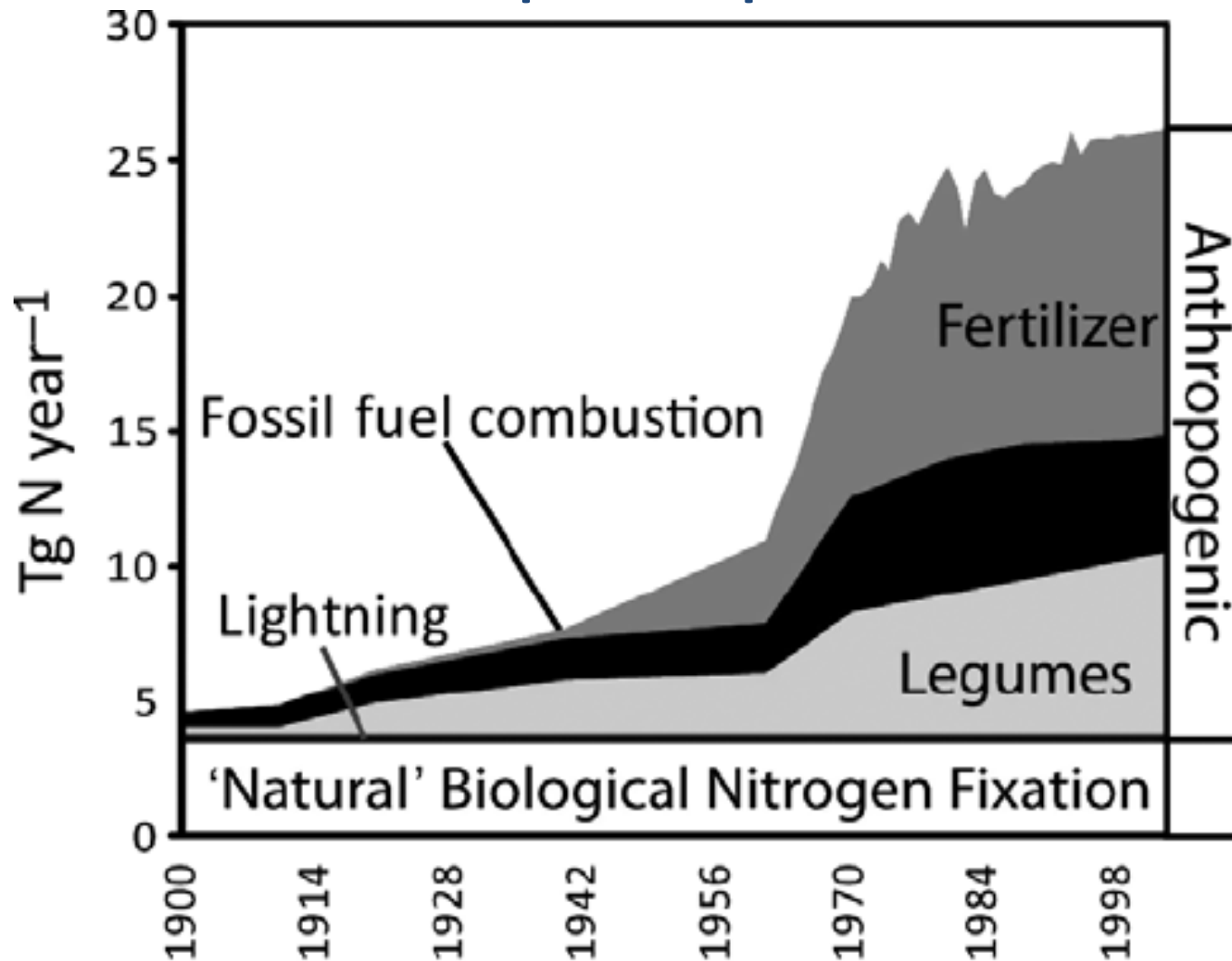
Christine Davis OAQPS

Jason Lynch OAR CAMD

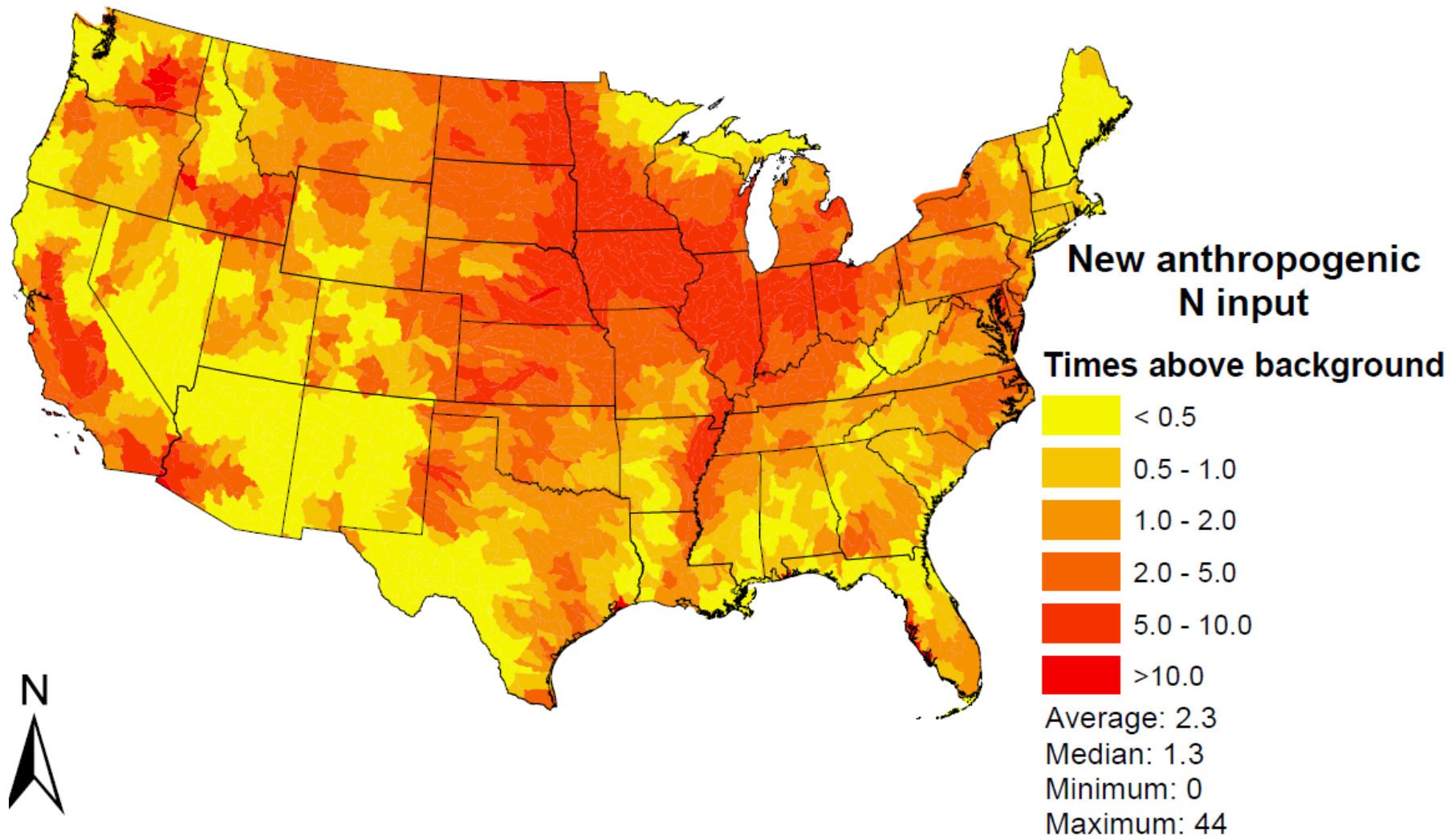
Expert hire: John Harrison,
WSU Vancouver

NRC post-docs Dan Sobota,
Michelle McCrackin

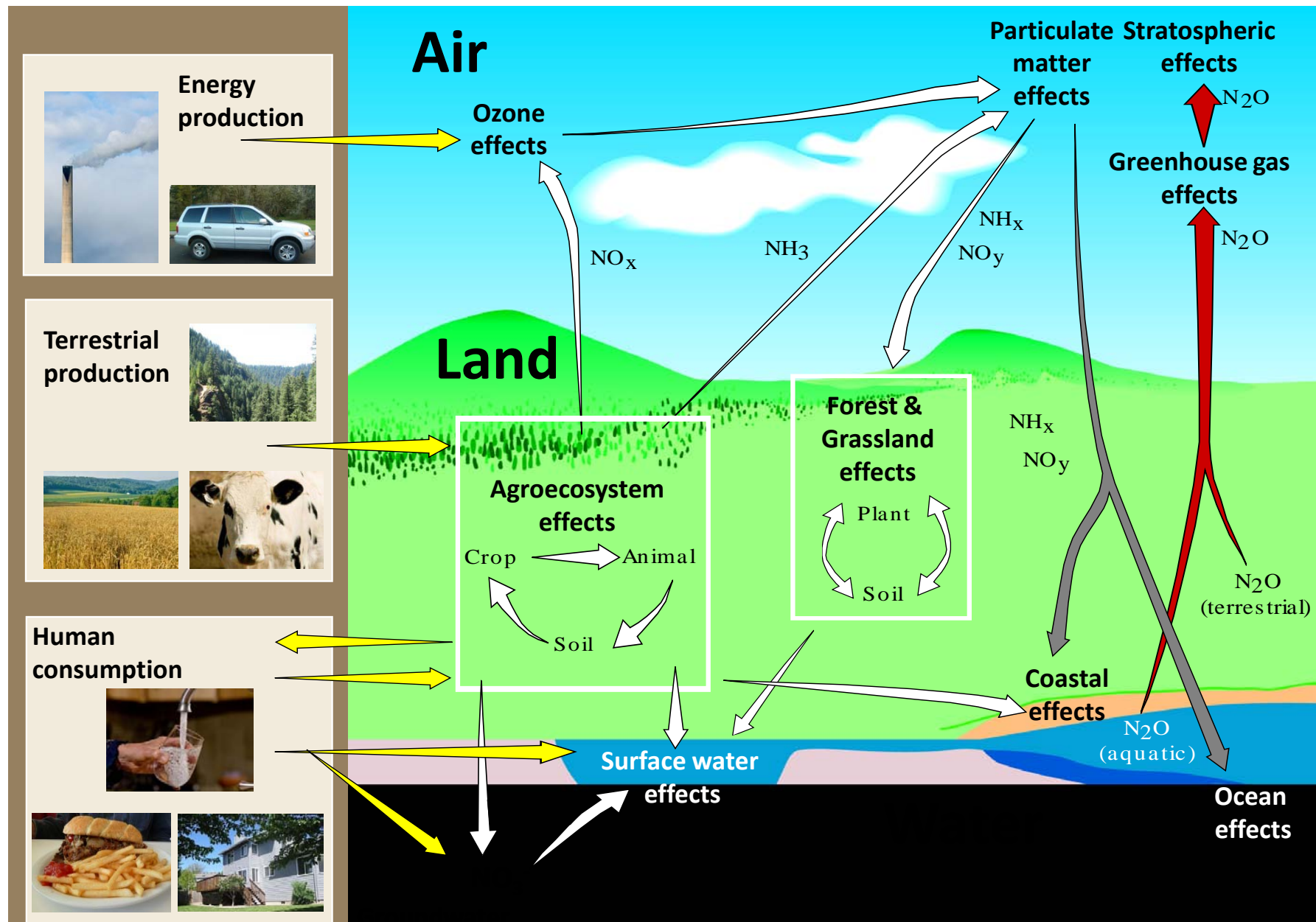
Human-driven increases in reactive N: temporal pattern



Human-driven increases in reactive N: spatial pattern

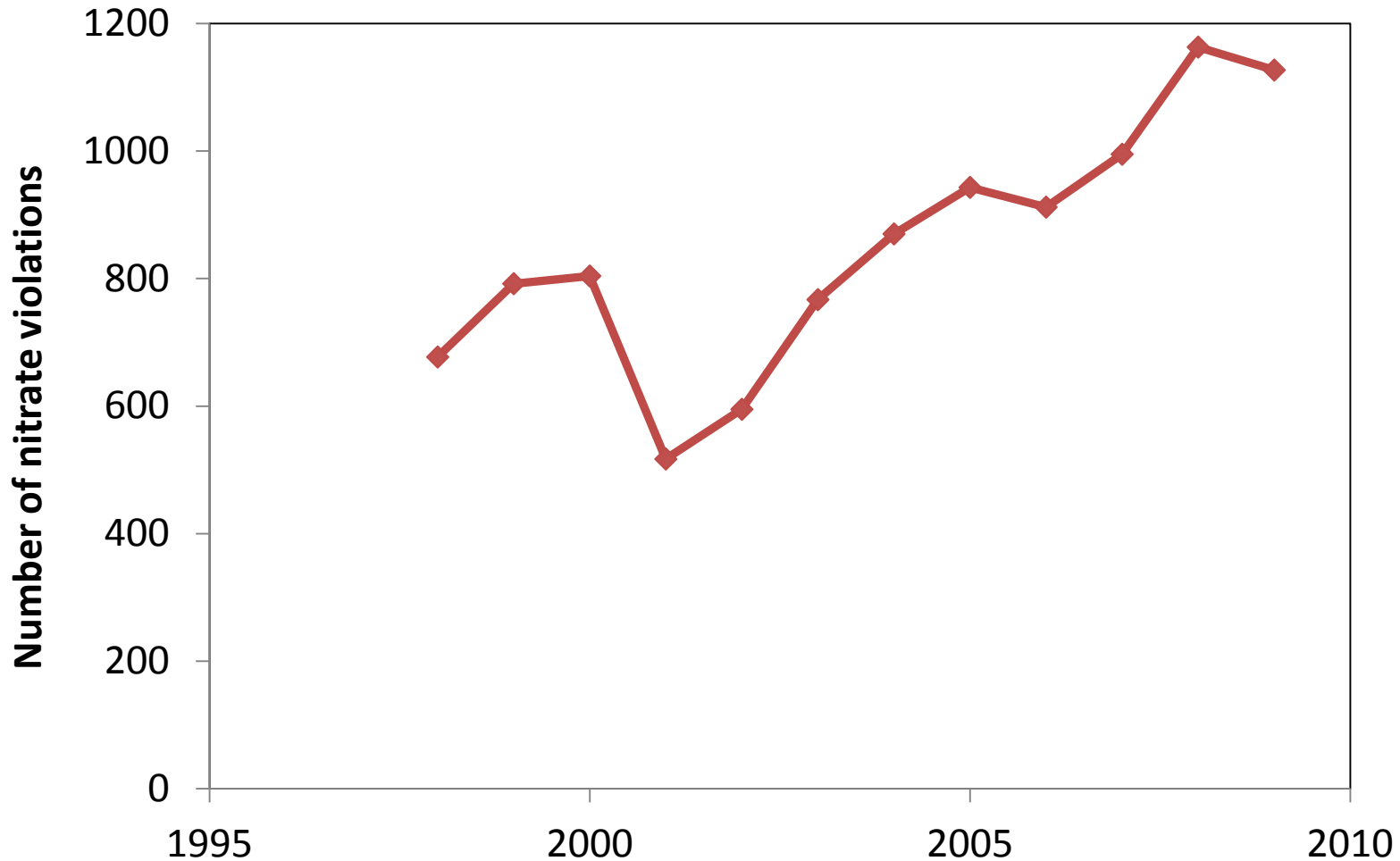


The nitrogen cascade



Increasing nitrate violations in drinking water

US Community Water Systems

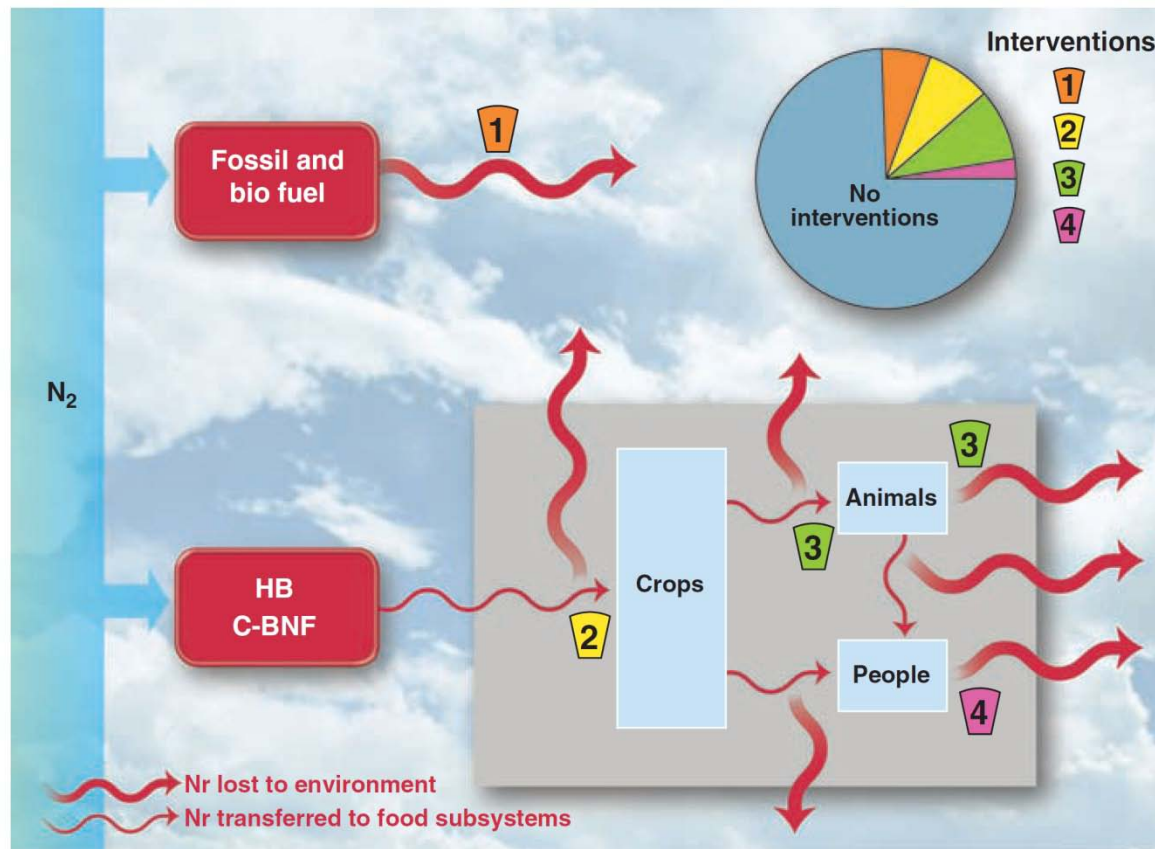


Questions for SHC-N:

- What is the current impact of N policies on ecosystem services and human well being, and how will this change in the future?
- What critical tools and information are needed for sustainable community, regional and national decisions about nitrogen?

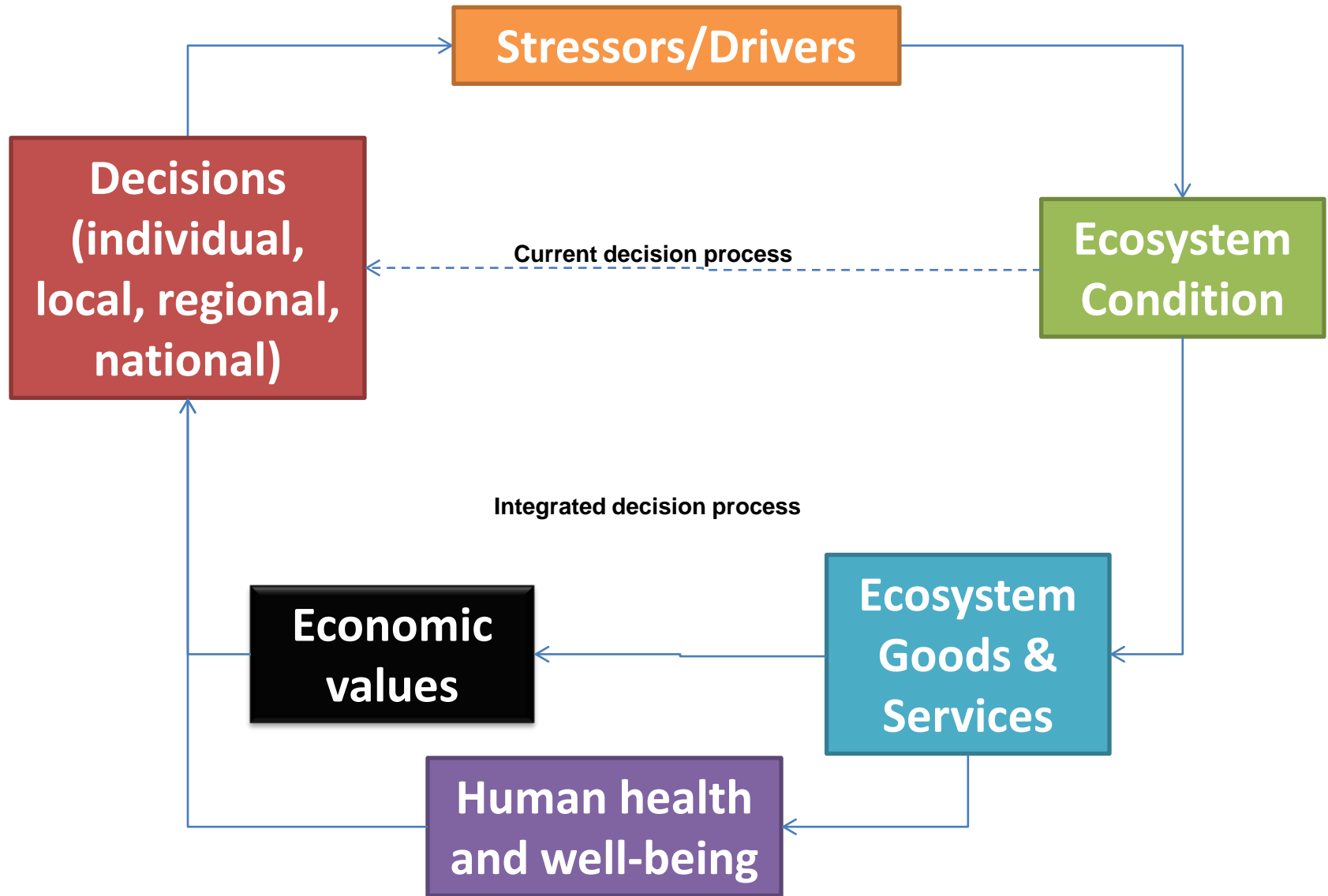
A specific charge:

If you were to reduce N by 25% ([SAB INC 2011](#)), what would be the most economically efficient, social acceptable, and environmentally sound way to do it?



Galloway 2008

Triple Bottom-Line



Research tasks within SHC-Nitrogen

Task #	Title	Task lead
3.3.1.1	Mapping nitrogen sources and nitrogen-impacted ecosystems at scales for national, regional and local decisions	Jana Compton
3.3.1.2	Informing sustainable nitrogen decisions using an ecosystem services framework	Steve Jordan
3.3.1.3	Interactive impacts of nitrogen deposition and climate change on ecosystems and ecosystem services.	Christopher Clark
3.3.1.4	Modeling to address atmospheric and ecosystem exposure and effects	Robin Dennis
3.3.1.5	Sustainable N management tools and case studies	Ken Forshay
3.3.1.6	Lake ecosystem services in the northeastern United States	Jeff Hollister
3.3.1.7	Effects of land use change associated with biofuel production scenarios on water quality and aquatic ecosystems.	Russ Kreis
3.3.1.8	Effects of hypoxia on provision of ecosystem services by marine benthic communities along the US Atlantic coast	Stephen Hale
3.3.1.9	Peatlands ecosystem services: Linking carbon and nitrogen dynamics with regional-scale air and water quality protection	Brian Hill
3.3.1.10	Large river floodplain restoration and re-connection effects on ecosystem services and nitrogen retention	Ken Forshay
3.3.1.11	Wetlands and nitrogen in Narragansett Bay watershed	Cathy Wigand

Outputs

- Output 1 – Mapping
- Output 2 – Ecosystem services response functions
- Output 3 – Scenario modeling
- Output 4 – Tools for sustainable N use

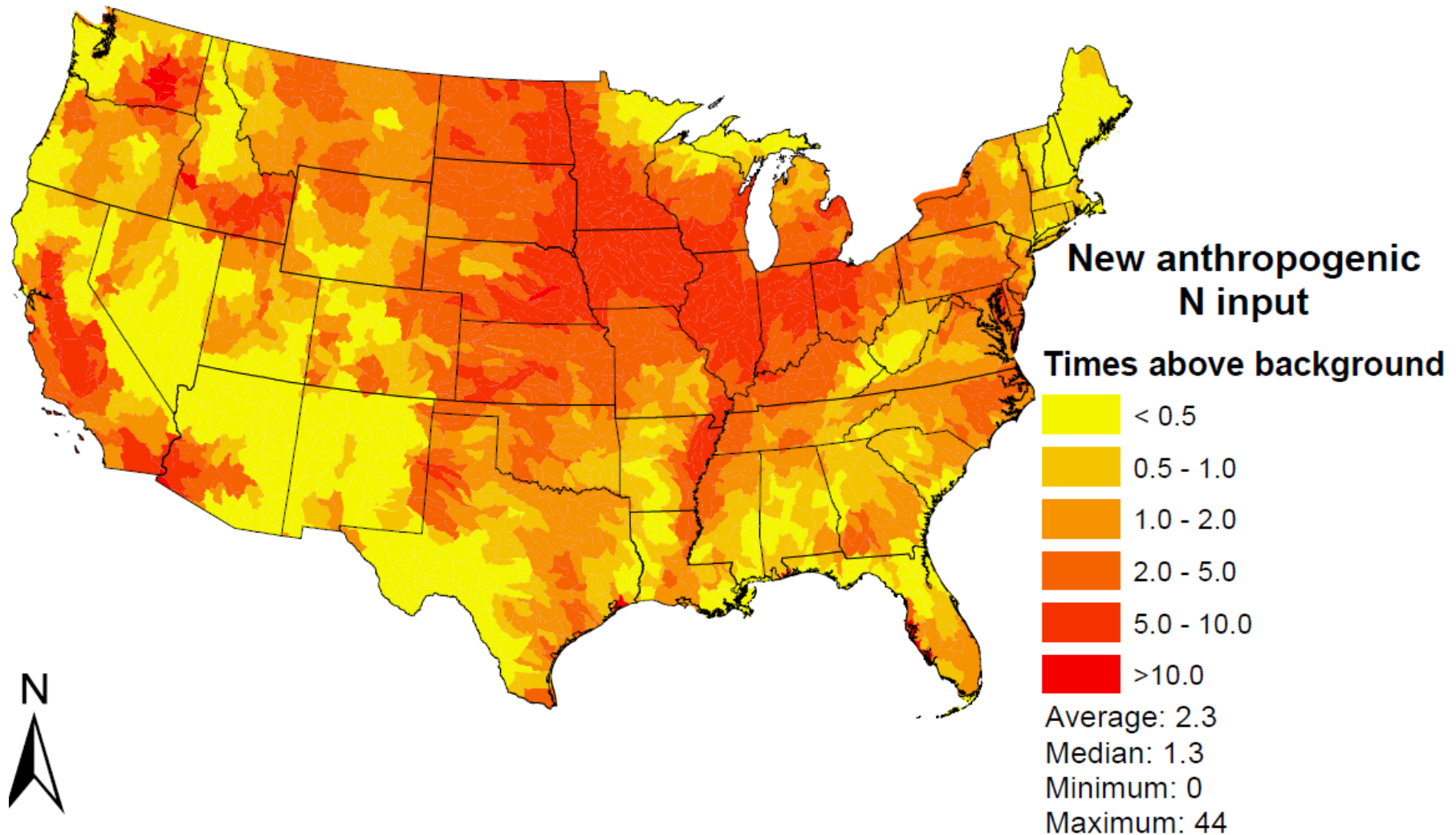
Output 1 - Mapping

Task 3.3.1: Jana Compton, Brian Hill

Expected products:

- Maps of nitrogen inputs to US at several levels of spatial and temporal resolution.
- Linkages between nitrogen sources and stream and river condition for US
- Life Cycle Analysis of nitrogen sources (in conjunction with output 2).
- Local testing and comparison of these N source maps and to validate and assess uncertainties.

Human-driven increases in reactive N: spatial pattern



Output 2 – Ecosystem services and well-being

Expected products

- Integrated scalable framework of response relationships between nitrogen and the ecosystem goods and service production, human health and well-being, and economic benefits functions.

Informing sustainable nitrogen decisions using an ecosystem services framework

Steve
Jordan
New lead
TBD

Interactive impacts of nitrogen deposition and climate change on ecosystems and ecosystem services.

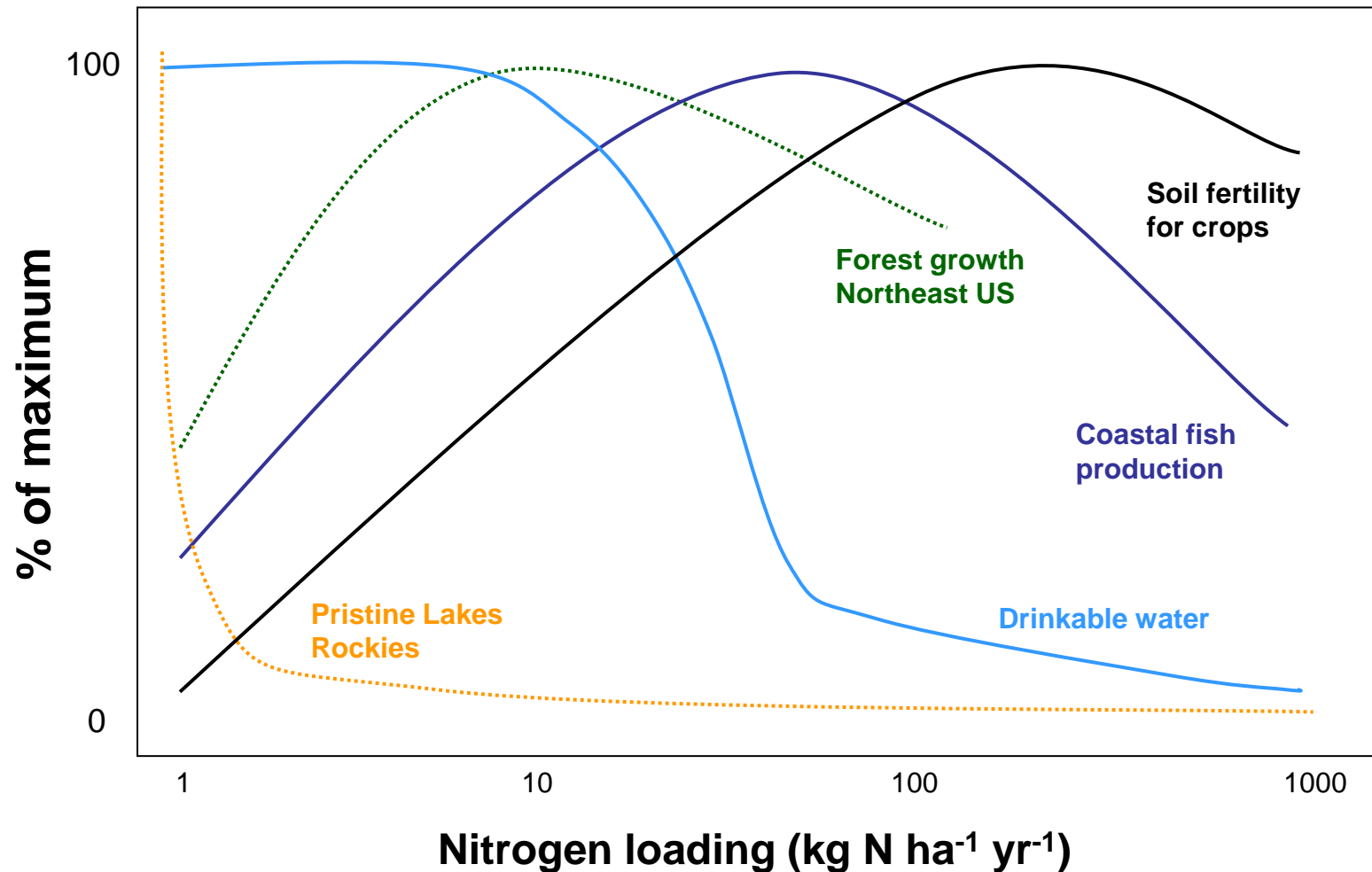
Christopher
Clark

Additional tasks feeding into output 2

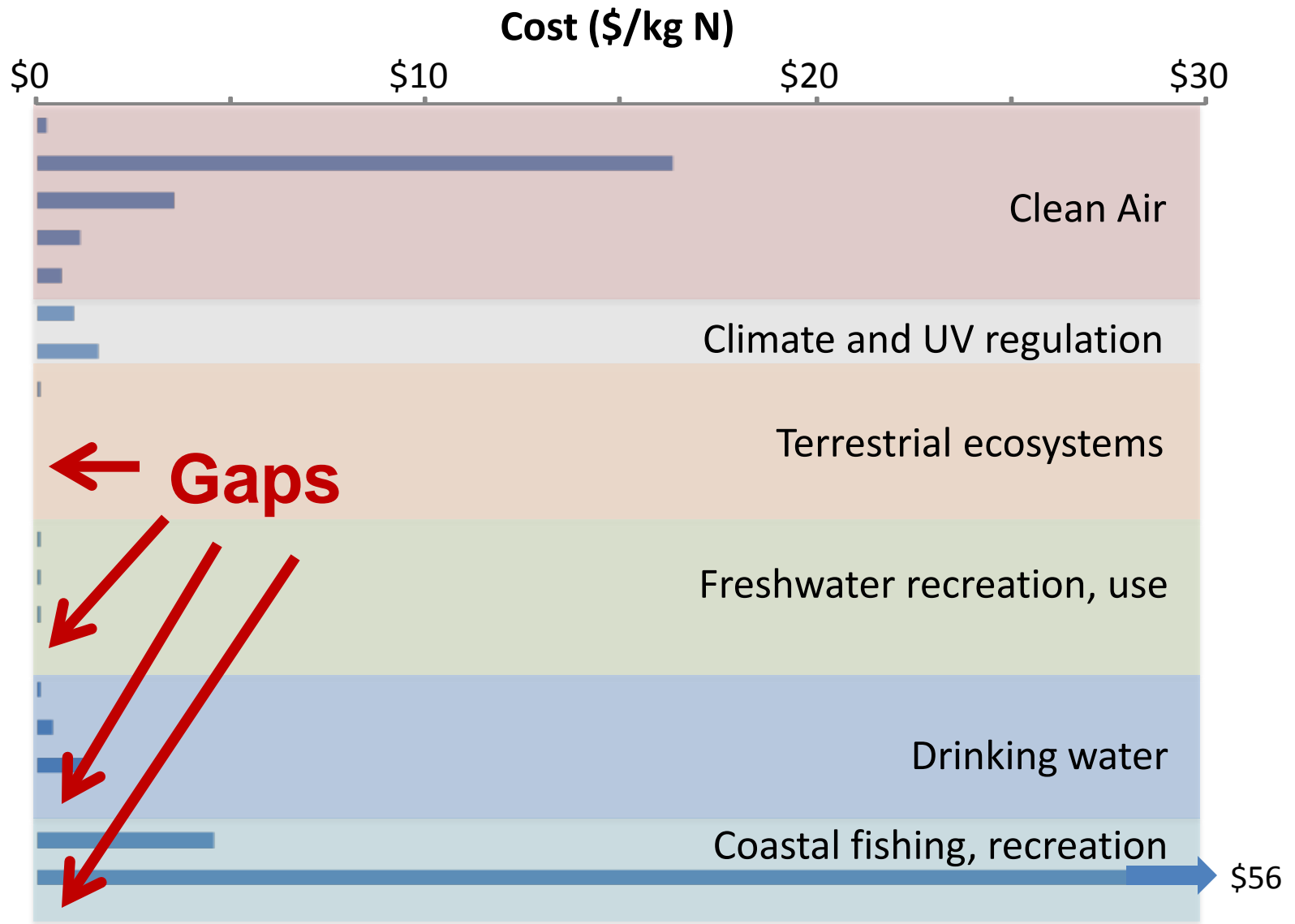
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Ecosystem service response functions



Effects of nitrogen on ecosystem services



Output 3 – Scenario Modeling

Overall output: Scenario analyses at two scales: regional vulnerabilities of communities to air and water quality exposure stemming from nitrogen sources, and local vulnerability of selected communities to up-airshed and up-watershed nitrogen pollution versus self-generated pollution.

Connections: Links to ACE Modeling/Decision support, SSWR Theme 1 Research on Nutrient Management; SHC Theme 1 National/Urban Atlas.

Expected Products

- Scenario studies for pilot communities (model development will occur in ACE).
- Integrated model outputs associated to help quantify regional and local vulnerabilities as part of existing decision support tool kits.

Output 4 –

Sustainable N management tools

Task:

Connections: Feed into SHC Theme 1, SSWR Science Questions 1 and 2.

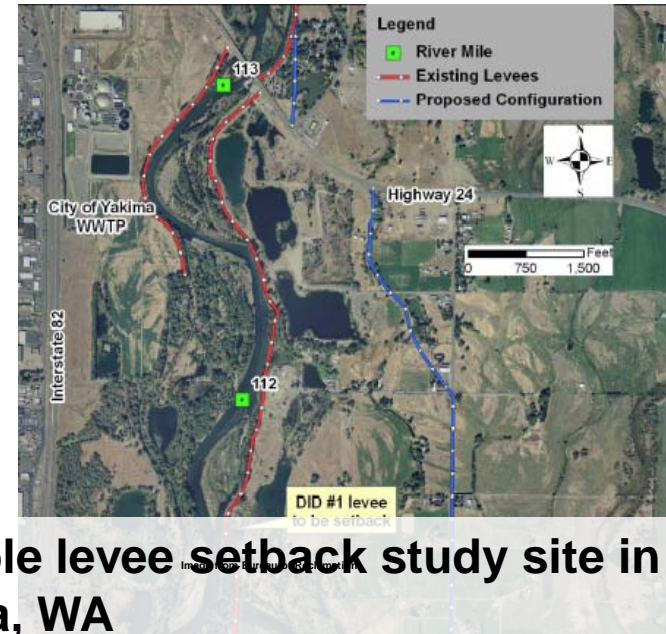
Expected products

- Tools for sustainable nitrogen management related to landscape planning, nutrient trading, and application of BMPs, including wetlands, agricultural systems, riparian buffers, river floodplains and green infrastructure.

K.J. Forshay and GWERD future tasks in SHC.

Large river floodplain restoration and re-connection effects on nitrogen retention in the Yakima and Willamette Rivers.

Collaborators on this work include R10 Sandy Halstead, GWERD B. Faulkner, R. Adeuya, WED S. Cline, R. Brooks, and McKenzie River Trust.

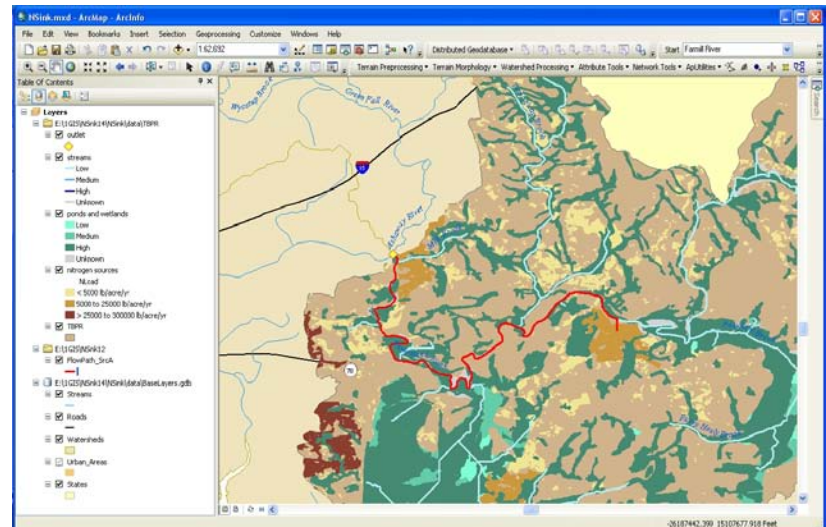


Possible levee setback study site in Yakima, WA

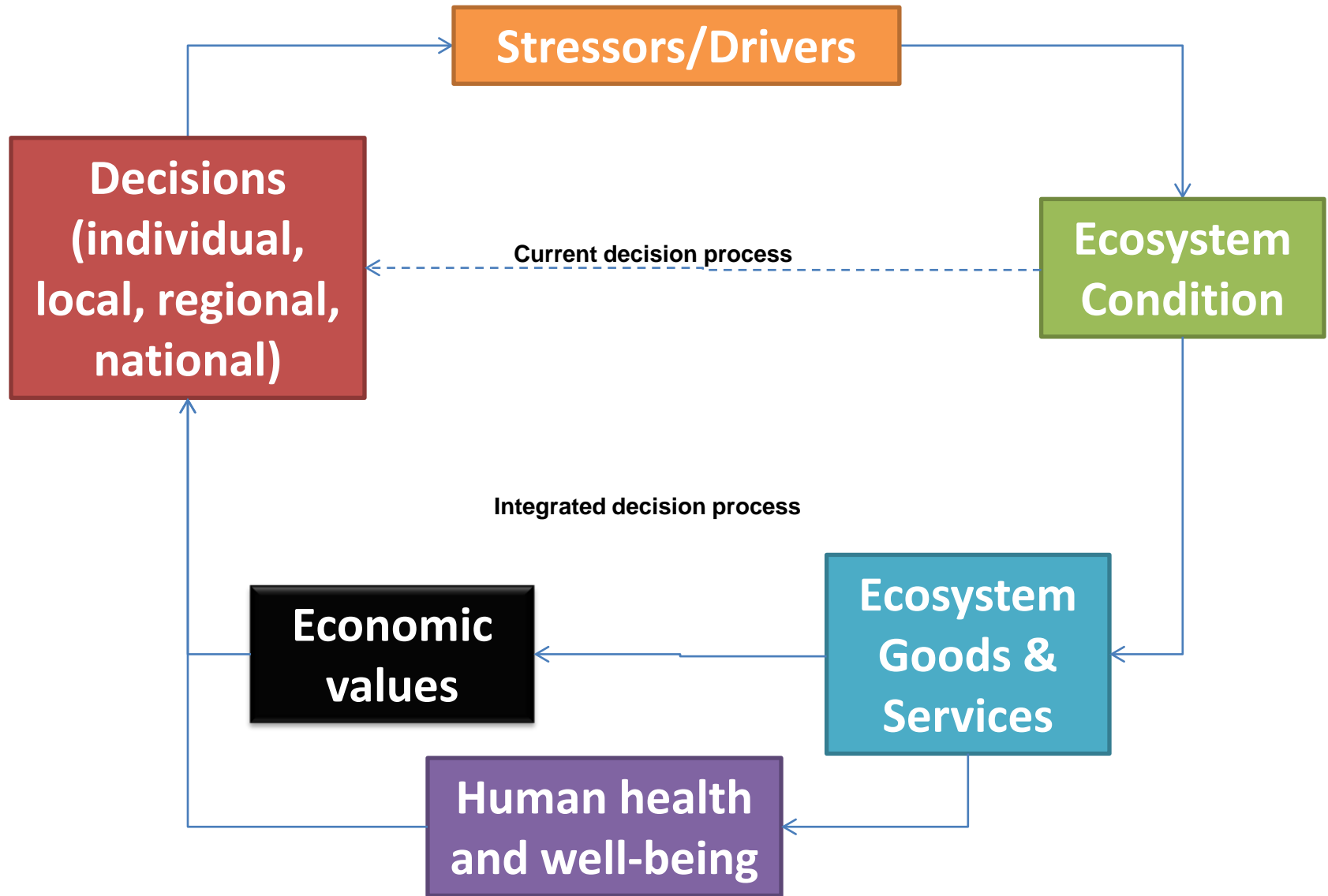
Sustainable N management tools and case studies. Specifically a tool to describe sources and sinks of N in a watershed called N-Sink.

Collaborators: URI's Q. Kellogg and A. Gold along with R. Adeuya, D. Burden and GWERD's modeling group

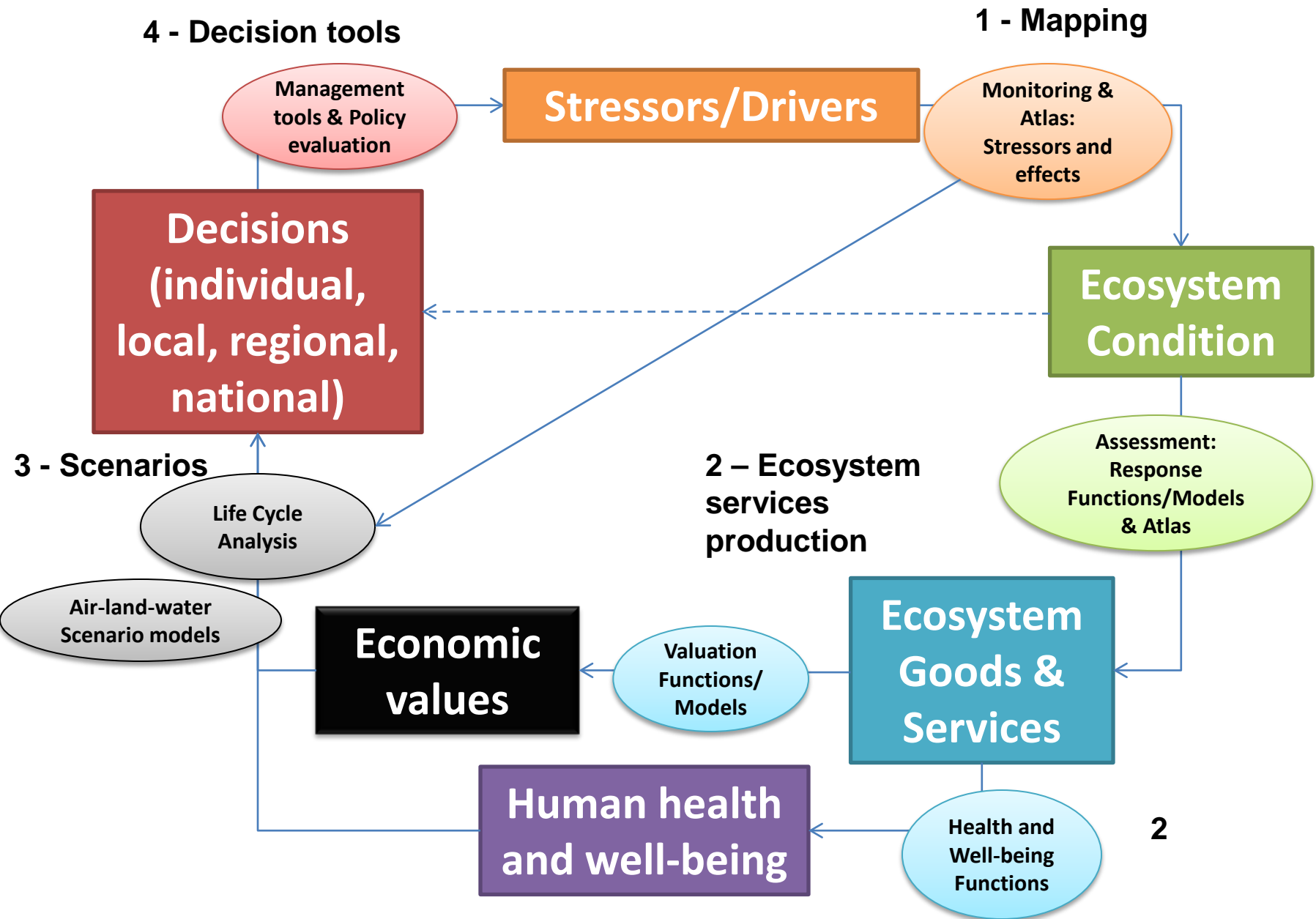
Example of flow path generated for N-Sink in ArcMap



Triple Bottom-Line



SHC-Nitrogen Critical Path



Overall Goals:

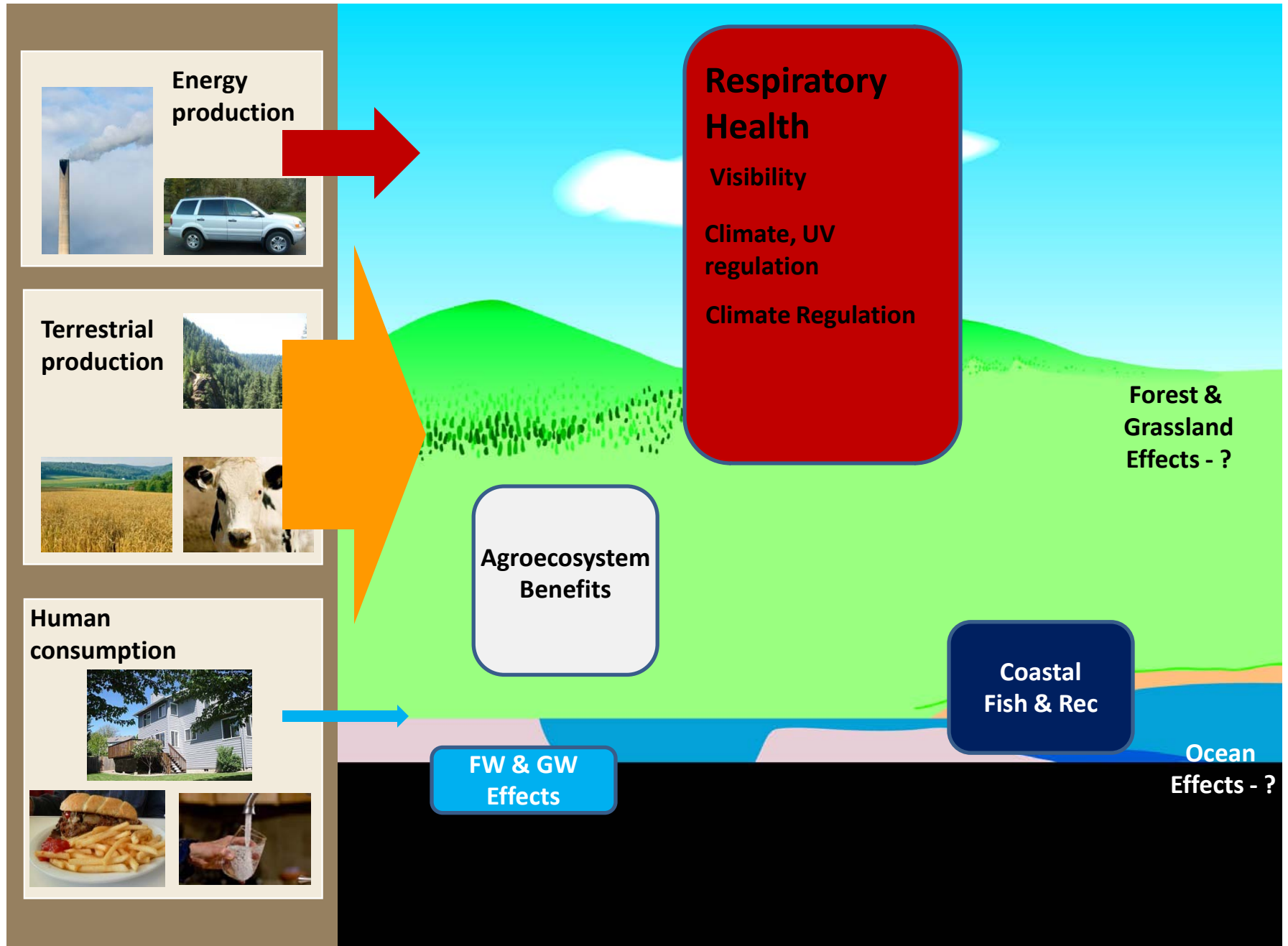
Sustainable nutrient management

- Better monitoring/mapping of nutrients
 - will require EPA to work better internally and with other agencies
- Connection of nutrient pollution to human benefits and values, using easy-to-understand units
- Life Cycle Analysis that accounts for full costs of N to inform and assess decisions about reductions



Fluxes

Impacts



Project Impacts

- **Air standards**

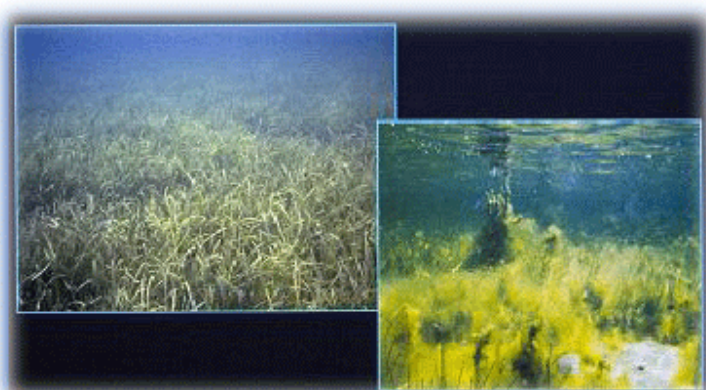
- inform future National Ambient Air Quality Standards review
- value and scope of the improvements in ecosystem services and condition with reductions in N and S deposition

- **Water quality**

- determinations of watershed nutrient loading and source apportionment
- link sources and loads to water quality

- **Communities –**

- Community application of the nutrient loading and management tools (connects to SHC Theme 1) and the dynamic modeling (connects to ACE)
- quantification of health and welfare effects for more encompassing decision support
- tools to help communities determine how to reduce N inputs



Overall SHC-N Outputs

Tools, maps, databases and scenario results that allow decision-makers to *balance the economic, social and environmental impacts of reactive nitrogen*.

Jana Compton
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